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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/749,618

12/30/2003

Steven K. Reinhardt

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EXAMINER

PARTRIDGE, WILLIAM B

ART UNIT

PAPER NUMBER

2183

MAIL DATE

DELIVERY MODE

11/26/2007

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

	Application No. 10/749,618	Applicant(s) REINHARDT ET AL.	
Office Action Summary	Examiner William B. Partridge	Art Unit 2183	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 04 October 2007.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 11-14 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 11-14 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
 Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|--|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)
2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____. | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
5) <input type="checkbox"/> Notice of Informal Patent Application
6) <input type="checkbox"/> Other: _____. |
|---|--|

DETAILED ACTION

Claims 1-10 have been canceled.

Claims 11-14 are newly presented.

Claims 11-14 are pending and have been examined.

Claim Objections

1. Claim 11 is objected to because of the following informalities:

The first use of the leading and trailing epochs lacks an antecedent basis, Examiner suggests that Applicant amend the second line to include the introduction of said epochs. Examiner suggests, "dividing a thread that is to be executed into a leading epoch and a trailing epoch [multiple epochs]".

Appropriate correction is required.

Claim Rejections - 35 USC § 112

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claims 11-14 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Regarding claim 11, the limitation "saving committed results" is indefinite in that the results are only committed after the comparison, not before (as per the last line of claim 11), so it is unclear how the results are already committed.

Claims 12-14 depend upon claim 11 and fail to resolve the issue presented above and are therefore rejected.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

4. Claims 11-14 are rejected under 35 U.S.C. 102(b) as being anticipated by Rotenberg (*"AR-SMT: A Microarchitectural Approach to Fault Tolerance in Microprocessors"*) herein referred to as Rotenberg.

Claim 11

Rotenberg teaches: **A method comprising: dividing a thread that is to be executed into multiple epochs** (Figure 2, A-Stream and R-Stream, Section 1.2 *Note: The R-stream lags behind the A-stream and is therefore a trailing thread*), **wherein each epoch includes 2 or more instructions** (Section 1.2 *Note: The streams each have multiple instructions*); **redundantly executing in parallel each epoch by separately executing corresponding leading and trailing epoch instances** (Figure 2, A-Stream and R-Stream, Section 1.2); **saving committed results from the executed corresponding leading and trailing epoch instances to memory** (Figure 2, Delay Buffer, Section 1.2); **comparing the committed results that should correspond to one another from the leading**

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and trailing epoch instances (Section 1.2, Paragraph 2, "As the R-stream is fetched and executed, it's committed results are compared to those in the Delay Buffer" *Note: The results of the A-Stream are stored in the Delay Buffer for comparison*); **and committing a single set of results for the executed epoch based on the compared results** (Section 1.2, Paragraph 2 *Note: If the comparison fails then a fault is detected and the results would not be committed as the actual result of the instruction given that the result is a known fault*).

Claim 12

Rotenberg teaches: **The method of claim 11, wherein the saved results are saved as speculative** (Section 1.2 *Note: As the status of the results could still be a fault they are inherently speculative*).

Claim 13

Rotenberg teaches: **The method of claim 12, wherein the two or more instructions executed in the execution of the epoch instances are buffered prior to epoch execution completion** (Figure 2, Delay Buffer).

Claim 14

Rotenberg teaches: **The method of claim 11, wherein only store results are compared** (Figure 2, Section 1.2 *Note: As the result is committed then it is a stored result*).

5. Claims 11-14 are rejected under 35 U.S.C. 102(b) as being anticipated by Reinhardt et al. ("*Transient Fault Detection via Simultaneous Multithreading*") herein referred to as Reinhardt.

Claim 11

Reinhardt teaches: **A method comprising: dividing a thread that is to be executed into multiple epochs** (Figure 3, Thread 0 and Thread 1, Section 3.1 *Note: The redundant thread may be time redundant and is therefore a trailing thread*), **wherein each epoch includes 2 or more instructions** (Section 3.1 *Note: The threads each have multiple instructions*); **redundantly executing in parallel each epoch by separately executing corresponding leading and trailing epoch instances** (Figure 3, Thread 0 and Thread 1, Section 3.1); **saving committed results from the executed corresponding leading and trailing epoch instances to memory** (Section 3.2, Paragraph 7, "register writeback comparison..." *Note: The results are stored in a register check buffer*); **comparing the committed results that should correspond to one another from the leading and trailing epoch instances** (Section 3.2, Paragraph 7, "register writeback comparison..." *Note: The values are compared and if they match then the value is committed*); **and committing a single set of results for the executed epoch based on the compared results** (Section 3.2, Paragraph 7, "register writeback comparison..." *Note: The values are compared and if they match then the value is committed*).

Claim 12

Reinhardt teaches: **The method of claim 11, wherein the saved results are saved as speculative** (Section 3.2, Paragraph 7, "register writeback comparison..." *Note: As the instructions have yet to be committed they are still speculative*).

Claim 13

Reinhardt teaches: **The method of claim 12, wherein the two or more instructions executed in the execution of the epoch instances are buffered prior to epoch execution completion** (Section 3.2, Paragraph 7, "register writeback comparison...").

Claim 14

Reinhardt teaches: **The method of claim 11, wherein only store results are compared** (Section 3.2 *Note: As the results are committed they are stored results*).

Response to Arguments

6. Applicant's arguments filed 10/4/2007 have been fully considered but they are not persuasive. Applicant argues in substance:

(1) **Neither reference teaches a process whereby threads to be redundantly executed are divided into multiple epochs (intervals) and then executed and**

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compared in a bulk fashion using the epochs, as taught by Applicant and recited in the new claim.

In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., comparing results in bulk fashion) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

While the claims do recite that each epoch includes two or more instructions the method in which the epochs are compared is not specified in the claims. As such the claims do not recite that the instructions are compared in bulk fashion or in any other means and only require that the epochs be compared. Both references teach duplicate thread execution and that the threads are compared and as such cover each and every limitation of the current claims.

Conclusion

7. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the

shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

8. Examiner respectfully requests, in response to this Office action, support be shown for language added to any original claims on amendment and any new claims. That is, indicate support for newly added claim language by specifically pointing to page(s) and line number(s) in the specification and/or drawing figure(s). This will assist Examiner in prosecuting the application.

9. When responding to this Office Action, Applicant is advised to clearly point out the patentable novelty which he or she thinks the claims present, in view of the state of the art disclosed by the references cited or the objections made. He or she must also show how the amendments avoid such references or objections. See 37 CFR 1.111(c).

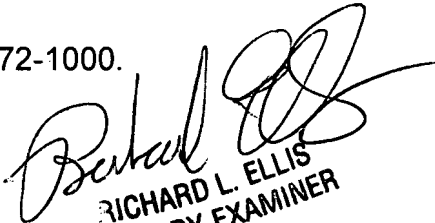
Any inquiry concerning this communication or earlier communications from the examiner should be directed to William B. Partridge whose telephone number is (571) 270-1402. The examiner can normally be reached on M-F 8:00 - 5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Eddie Chan can be reached on (571) 272-4162. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Examiner: William B. Partridge
Date: 11/5/2007


RICHARD L. ELLIS
PRIMARY EXAMINER